



# DIAL ELECTRONIC

Universal Midi Control Electronics for rotary encoders

## Installation and User's Guide

## Electrical safety / EMC compatibility

**DIAL ELECTRONIC** (abbreviated "*DE*" in the following) is a so-called **OEM product** (OEM original equipment manufacturer) that cannot be used independently but has to be combined with additional electrical or electronical equipment to become a working device (e.g. rotary encoders, switches, LEDs, power supply, case/housing). The manufacturer of *DE* does not know the final assembly of the complete device in which the *DE* is used as a part of the complete device. The final responsibility with regard to **electrical safety** and **electromagnetic compatibility** is up to the user who is assembling the complete device.

***Electronic basic knowledge is required to install DE and to connect the rotary encoders, switches and LEDs.*** If you are not sure whether your knowledge is sufficient please consult an expert. We cannot take back modules that became defective because of wrong installation or wrong connection of the controls.

Please pay attention to the following items:

The **power supply** used in combination with the *DE* has to be a closed type (in Germany a power supply with VDE approval is required). Normally an AC adapter with plastic case is used. It is not allowed to use **open power supplies** which open **mains voltage** access (e.g. via mains lead, pcb tracks, electronic parts).

On the *DE* **preventing measures** against **electromagnetic radiation** are taken (RF filters at the power supply input and the Midi lines). But it is impossible to estimate to what extent the **components added by the user** affect the **EMC properties** of the complete assembly. Therefore the **complete device** has to be **shielded** against **electromagnetic radiation** (incoming and outgoing). These demands are normally met by a closed metal case that covers the complete assembly. The metal case should be connected to GND of the *DE*.

## Warranty

- Do not solder directly to any of the pin headers but use female connectors to make the connections between *DE* and the rotary encoders, switches and LEDs. A cable set that contains all required connectors and cables is included with *DE*.
- Carry out all connections in the off-state of *DE* (i.e. when powered-off only) !
- Do not connect any voltage to the pin headers but only the encoders, switches and LEDs as described in this manual.
- *DE* electronics is an electrostatic sensitive device. Avoid any electrostatic charges !
- Avoid short circuits !
- Ignoring any of these items will cause warranty loss !
- Return of the *DE* within the 2 weeks return time limit (valid only in Germany) is only possible if all these items have been met. Return of used cable sets is not possible. We also cannot take back modules that have been soldered by the user.

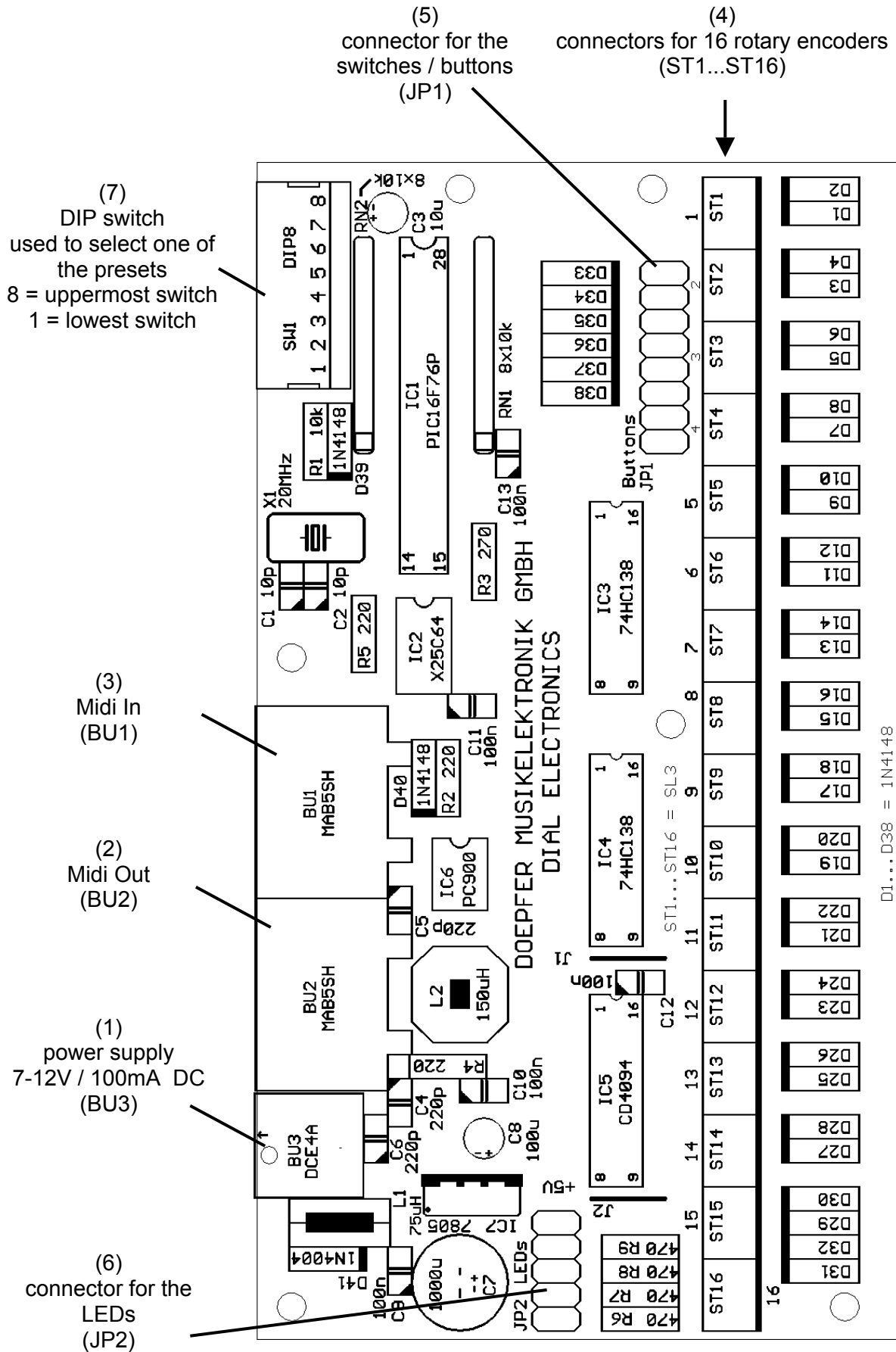
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## Introduction

- **Dial Electronic** (abbreviation: "*DE*" in the following) is an universal electronics DIY kit to built your own MIDI control box with 16 rotary encoders (even called alpha dials, endless potentiometers or similar).
- *DE* generates 16 different MIDI messages on different (or even the same) MIDI channels. The available Midi messages are described in the Pocket Dial manual. The most important messages are probably the Midi Control Change messages – often simply called "Midi controllers". In the following we are sometimes talking about Midi controllers though other Midi messages are possible.
- *DE* can be combined with the MKE, Pocket Electronic, CTM64 or MTC64 to obtain a unique controller that fits exactly to the user's requirements.
- *DE* essentially contains the same electronics as **Pocket Dial** but without the 16 rotary encoders, switches and LEDs. Concerning the Midi functions *DE* is 100% identical to Pocket Dial. Therefore the user's manual of Pocket Dial is part of the *DE* delivery. The basic functions of *DE* and the programming of the Midi functions is described in the Pocket Dial manual.
- This manual describes only the connections of the controls (rotary encoders, switches, LEDs) to *DE*.
- The controls (rotary encoders, switches, LEDs) are not included but have to be added by the customer. We offer a suitable control set (16 encoders with black knobs, 6 buttons, 4 LEDs, cables) that has to be purchased separately.
- The 16 rotary encoders are connected to 16 single row pin headers with 3 pins each. The switches are connected to a double row pinheader with 16 pins. The LEDs are connected to a double row pinheader with 10 pins. To these headers suitable ribbon cables (with 3/10/16 pins) are put up. The terminals of the encoders, switches and LEDs are soldered to the free ends of the ribbon cables. In this way the controls might be disconnected from the electronics very easily.
- *DE* is equipped with Midi In and Midi Out. The incoming Midi messages are merged to the data generated by *DE*. In this way several *DE* can be linked together to obtain larger controller arrays with more than 16 controls or can be combined with other OEM products like Pocket Electronic, CTM64, MKE and similar.
- The *DE* configuration (i.e. the assignment of Midi messages and channels to the controls in the 128 presets) is made with an editor program (PC version, free download from our web site [www.doepfer.com](http://www.doepfer.com)). It enables the user to program his own 128 presets. The OEM version of Emagic's Sounddiver is available too (extra charge).
- The factory presets are described in the the Pocket Dial manual. These can be changed with the editor program.
- An external power supply (7-12VDC@min. 100mA) is required for the *DE*. It is included for all shipments within Germany (230V version with European mains plug). For shipments outside Germany please ask your local representative or dealer.
- We do not offer a suitable housing as this would have to be completely different for various combinations of controls.
- *DE* is available only as an assembled and tested pc board (about 125 x 70 x 25 mm). Six mounting holes with 3 mm diameter are available for mounting the pc board to a suitable base e.g. with distance sleeves or spacers and screws.

# Connections



## **Power Supply (1)**

*DE* does not have a built-in power supply. Instead it uses a plug-in type external power supply (AC adapter). One reason for this feature is electrical safety. Keeping danger voltages (main) out of the *DE* increases the electrical safety. Therefore an external power supply of high quality and safety should be used. If *DE* is used in Germany the external power supply has to be VDE approved. Another reason for the external power supply is the fact that mains voltages and plug types vary considerably from country to country. Using a plug-in external supply *DE* can be used any where with a locally purchased power supply, thus keeping the retail price down.

The power supply has to be able to deliver 7-12 V unstabilized DC voltage, as well as a minimum current of 100mA. *DE* is switched ON by plugging the AC adapter into a wall outlet and connecting it to the appropriate jack on the *DE* board. There is no separate on/off switch. If the polarity of the power supply is incorrect, *DE* will not function. However, there is no danger of damage to the circuitry since it is protected by a diode. The correct polarity is: outside ring = GND, inside lead = +7...12V. A power supply for 230V mains voltage with European type mains plug is included with the *DE* (valid only within Europe, for other countries ask you local Doepfer representative or dealer).

## **Midi Out Socket (2)**

Connect the Midi Out socket with Midi In of the device to be controlled by *DE* (e.g. Computer, Synthesizer, second daisy-chained *DE* or another OEM/DIY product like MKE, CTM64, Pocket Electronic) via a suitable Midi cable. If you want to control more than one Midi device you have to use daisy chain Midi Thru / Midi In connection of the devices or use a external Midi Thru box.

## **Midi In Socket (3)**

The *DE* features a Midi input. This input may be connected to another Midi device (e.g. Midi keyboard). The incoming Midi data are merged to the data generated by *DE*. The Midi input may be used as well for daisy-chaining several *DE*. The Midi input of *DE* is not suitable for large amounts of Midi data (e.g. SysEx strings or Midi messages coming from an computer sequencer) as the *DE* has only a small Midi in buffer. In case of large amounts of incoming Midi data loss or delay of data may occur.

The Midi input is also required when *DE* is programmed with the editor software. In this case the Midi input of *DE* has to be connected to the Midi output of the computer on which the editor program is running. The Midi output of *DE* has to be connected to the Midi input of the computer. Details can be found in the Pocket Dial manual and the manual of the editor program.

Even if *DE* is used to generate absolute Midi control change messages with data update/feedback from the device controlled by *DE* the Midi In of *DE* has to be connected to Midi Out of the device in question. Details about this mode are available in the Pocket Dial user's manual.

If none of the applications described above is used the Midi input is left open.

## **Connectors for the 16 rotary encoders (4)**

For the connection of 16 rotary encoders the 16 single row pin headers ST1...ST16 (3 pins each) are available.

A rotary encoder has three terminals available: common terminal, output 1 and output 2. When operating the encoder the outputs 1 and 2 are shorted to the common terminal in a certain sequence (different for right and left rotation). In the end an encoder is nothing but two switches with one common terminal. The *DE* decodes this switching sequence and generates the corresponding Midi messages.

The lower pin of each pin header (refer to the picture on page 6) corresponds to the common terminal of the encoder. The other two pins correspond to the (active) switches of the encoders. Please look into the data sheet of the encoder used to find out the pin assignment of your encoder. If the two active terminals are mixed up the Midi function is reverse. We recommend to connect only one encoder at first to find out the correct polarity before the other encoders are connected. If the terminals are connected in the wrong way nothing can be damaged but the encoder will not work correctly (i.e. no function or reverse).

If ALPS encoders EC16B24 are used the order of the three pins matches to the pin headers of the *DE*. These encoders are available as single spare parts or as a complete control set for *DE* (16 encoders with black knobs, 6 buttons, 4 LEDs, cables) that has to be purchased separately.

Suitable 3-pin female connectors with cables can be used to connect the encoders to the pin headers ST1...ST16 instead of soldering the cables directly to the pin headers. We strictly recommend this type of wiring but not to solder the wires directly to the pin headers. Usage of cables with female connectors allows to disconnect the encoders from the electronics very easily. Suitable female connectors with cables are available as single spare parts and are even included with the control set for *DE*.

Unused encoder connectors are left open (no termination required).

*Remark (only if the Dial Electronics control set is used):*

*The measure of the 3 pin female connector of the cable sets is a little bit more than the corresponding pin header on the pc board. Consequently the female connectors have to be grinded off a bit (e.g. with sandpaper). Otherwise several female connectors will not fit side by side.*

### Connector for 6 control switches (5)

The pin header JP1 is used to connect 6 control switches (momentary switches, buttons). This is the pin out of JP1 (refer to the picture on page 6):

T1a	T1b
T2a	T2b
T3a	T3b
T4a	T4b
T5a	T5b
T6a	T6b
NC	NC
NC	NC

Each of the 6 switches (labelled T1 ... T6) has two terminals (a and b) that have to be connected to the corresponding pins of the pin header. The first switch has to be connected to the pins T1a and T1b, the second to T2a and T2b and so on. Simple momentary switches (open at rest) are used.

The 4 lower pins are not used (NC = not connected).

We recommend the usage of a 16 pin female connector with 16 pin ribbon for this connection. The switches are soldered to the open ends of the ribbon cable. The female connector with ribbon cable is included with the *DE* control set.

### Connector for 4 LEDs (6)

The pin header JP2 is used to connect 4 LEDs. This is the pin out of JP2 (refer to the picture on page 6):

NC	NC
L1+	L1-
L2+	L2-
L3+	L3-
L4+	L4-

Each LED has two terminals: + (positive terminal or anode) and – (negative terminal or cathode). The shortened LED pin is normally the cathode. Each of the 4 LEDs is connected to the corresponding pins Lx+ (positive LED terminal) and Lx- (negative LED terminal). The first LED is connected to L1+ and L1-, the second to L2+ and L2- and so on. Almost each LED type can be used (3mm / 5mm / rectangle, red / orange / yellow / green / blue / white).

The two upper pins of JP2 are not used (NC = not connected).

We recommend the usage of a 10 pin female connector with 10 pin ribbon for this connection. The LEDs are soldered to the open ends of the ribbon cable. The female connector with ribbon cable is included with the *DE* control set.



It has to be pointed out that we cannot take back DE modules with solder residues on the pin headers ! Therefore we recommed the usage of female for the encoders, switches and LEDs.

The functions of the switches and LEDs is the same as for Pocket Dial. Please refer to the Pocket Dial manual that is included with the DE delivery.

### ***DIP Switches (7)***

The positions of the 8 switches of SW1 (7) determine the number of the preset that is called up during power on. Up to 128 different presets are available. If none of the factory presets can be used the editor program enables the user to program his own presets.

The function of the DIP switches and the connection between the position of the switches and the preset number is described in the Pocket Dial manual.

*Pay attention to the numbering of the 8 switches in the picture on page 5. The numbering printed to the DIP switch may differ from this numbering. Please use only the numbering of the switches in this manual to select a preset !*

## Check list

In case that your *DE* installation does not work at the first go please check the following points:

- Is the power supply working correctly ? Provided that the 4 LEDs are connected to JP2 they have to light up one after the other and then LED #1 has to light up only.
- Are the controls (encoders, switches, LEDs) connected as described in this manual ?
- Was no short circuit made (neither in the wiring nor mounting) ?
- When the diode D41 and the voltage regulator IC7 become hot probably a short circuit between GND and +5V was made !
- Are the Midi connections between *DE* and the other Midi devices installed correctly ? Midi Out of *DE* has to be connected to Midi In of the Midi device controlled by *DE*. Especially when computers are used Midi In and Out are very often mixed up by the user. Once again: Midi Out → Midi In (not Midi Out → Midi Out nor Midi In → Midi In).
- Please use only cables that are suitable for Midi.
- When a PC with sound card is used only high quality multimedia cables should be used. Low cost multimedia cables without optocouplers for Midi In and without drivers for Midi Out very often cause Midi data problems.
- Is the right preset number selected with the DIP switch ? A good preset number for testing is no 1: if 8 switches are "off" one obtains volume on the Midi channels 1...16 (provided that the factory presets are unchanged, otherwise the Midi messages you have programmed to preset no 1 will appear).

## Mounting

Before *DE* is put into operation the board has to be fixed on a suitable support and built into a metal case together with the controls (refer to EMC notes on page 2). The metal case has to be connected to GND of *DE*. We recommend to use the metal plate of the voltage regulator 7805/IC7 or the GND terminal of the power supply socket for this connection.

Several mounting holes with 3 mm diameter are available for mounting the board inside the case e.g. with distance sleeves or spacers (> 5 mm in length) and suitable screws. Pay attention that no short circuits are made – neither on the top of the board (electronic parts) nor on the bottom (solder points or pcb tracks). In case of doubt use isolating plastic parts (e.g. plastic screws, nuts and washers) for mounting.

## Extent of delivery

The *DE* delivery contains the following parts:

- Dial Electronic pc board, assembled and tested
- Power Supply (230V mains voltage, European type mains plug, output voltage range 7...12V, current min. 100 mA) included only for shipments within Germany, for shipments outside Germany please contact your local representative or dealer
- Dial Electronic user's guide (i.e. the guide in your hand)
- Pocket Dial user's guide

Rotary encoders, switches, LEDs and cables are not included but have to be added by the customer. We offer a suitable control set (16 encoders with black knobs, 6 buttons, 4 LEDs, cables) that has to be purchased separately.

The DE control set contains the following parts:

- 16 rotary encoders (ALPS EC16B24)
- 16 black rotary knobs (same as used for Pocket Dial)
- 16 cable sets with female connectors for the encoders
- 6 momentary switches (round, with thread for mounting into a front panel)
- one 16 pin ribbon cable with 16 pin female connector, about 30 cm (for wiring the switches to JP1)
- 4 LEDs (red, 3 mm)
- one 10 pin ribbon cable with 10 pin female connector, about 30 cm (for wiring the LEDs to JP2)

*Remark:*

*The measure of the 3 pin female connector of the cable sets is a little bit more than the corresponding pin header on the pc board. Consequently the female connectors have to be grinded off a bit (e.g. with sandpaper). Otherwise several female connectors will not fit side by side.*

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